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Yerli

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(54) **LIVE MANAGEMENT OF REAL WORLD VIA A PERSISTENT VIRTUAL WORLD SYSTEM**

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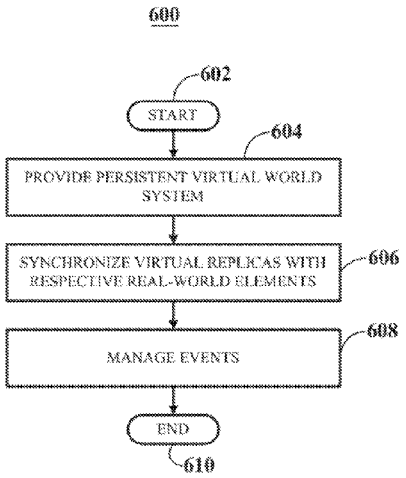
(57) **ABSTRACT**

A method enabling live management of events in the real world through a persistent virtual world system comprises providing in the memory of a server a database with structured data storing a persistent virtual world system comprising virtual replicas of real-world elements; synchronizing the virtual replicas with the respective real-world elements by using a plurality of connected elements connected to the server via a network, the connected elements comprising sensing mechanisms configured to capture data from the real-world elements; and managing events in the real world through the synchronized persistent virtual world system. Management of events comprises monitoring activity in the real world through a persistent virtual world system; detecting the events; checking whether events fall within one or more predetermined analysis requirement parameters; defining timeframe of events; storing the events in the memory; recreating the events; and analyzing the events.

20 Claims, 7 Drawing Sheets



(51) **Int. Cl.**

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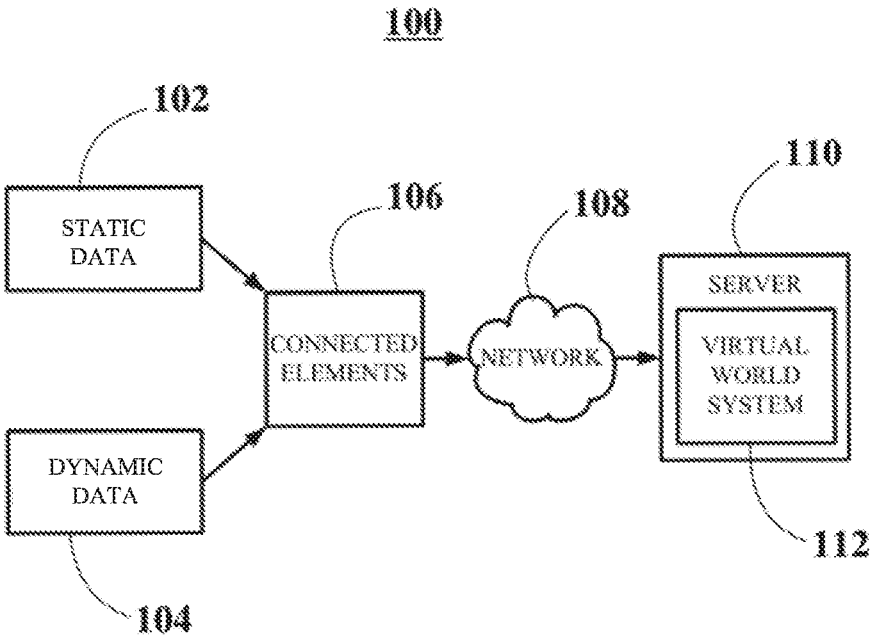
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102
STATIC DATA
106
CONNECTED ELEMENTS
108
NETWORK
110
SERVER
VIRTUAL WORLD SYSTEM
112
DYNAMIC DATA
104

FIG. 1

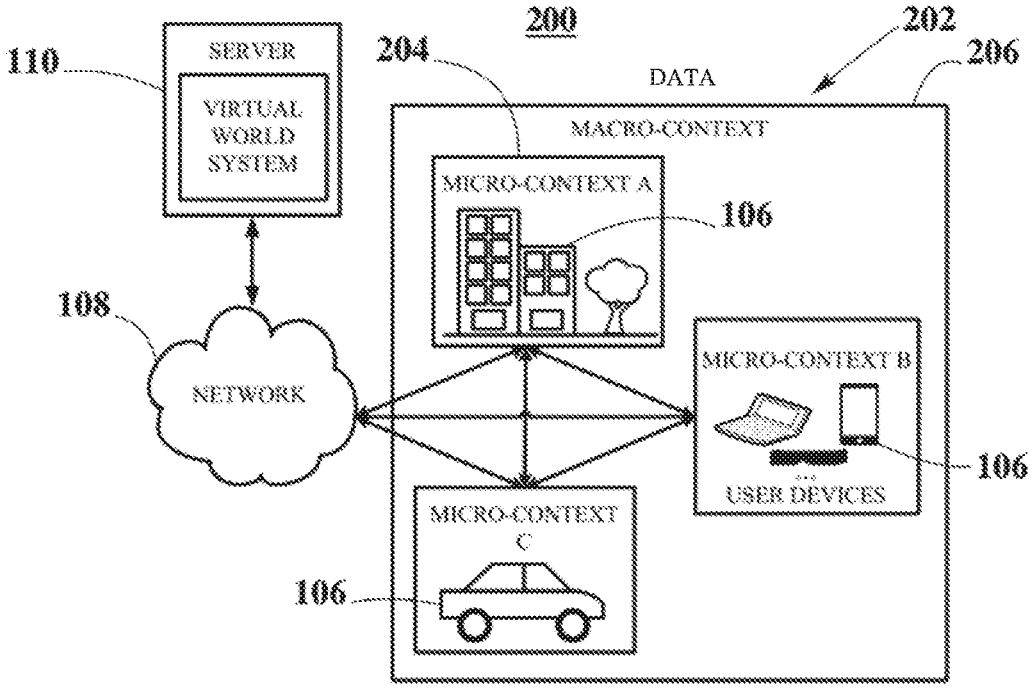
200
202
110
SERVER
VIRTUAL WORLD SYSTEM
204
DATA
206
MACRO-CONTEXT
MICRO-CONTEXT A
106
108
NETWORK
MICRO-CONTEXT B
106
USER DEVICES
MICRO-CONTEXT C
106

FIG. 2

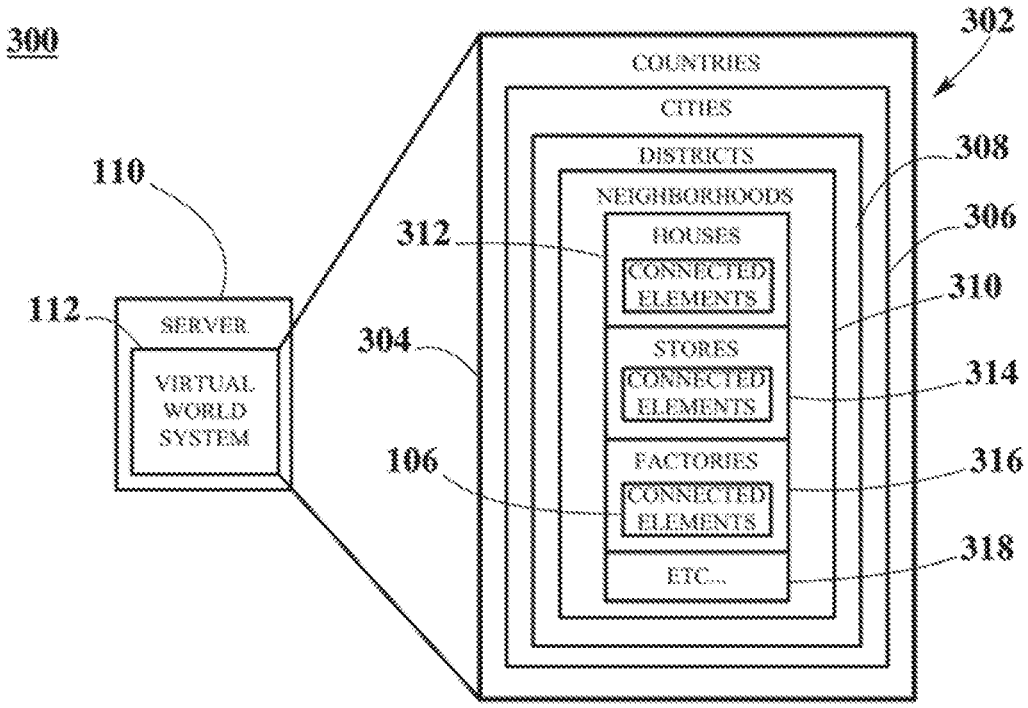
300
302
COUNTRIES
CITIES
DISTRICTS
NEIGHBORHOODS
HOUSES
CONNECTED ELEMENTS
STORES
CONNECTED ELEMENTS
FACTORIES
CONNECTED ELEMENTS
ETC...
110
112
SERVER
VIRTUAL WORLD SYSTEM
312
304
106
308
306
310
314
316
318

FIG. 3

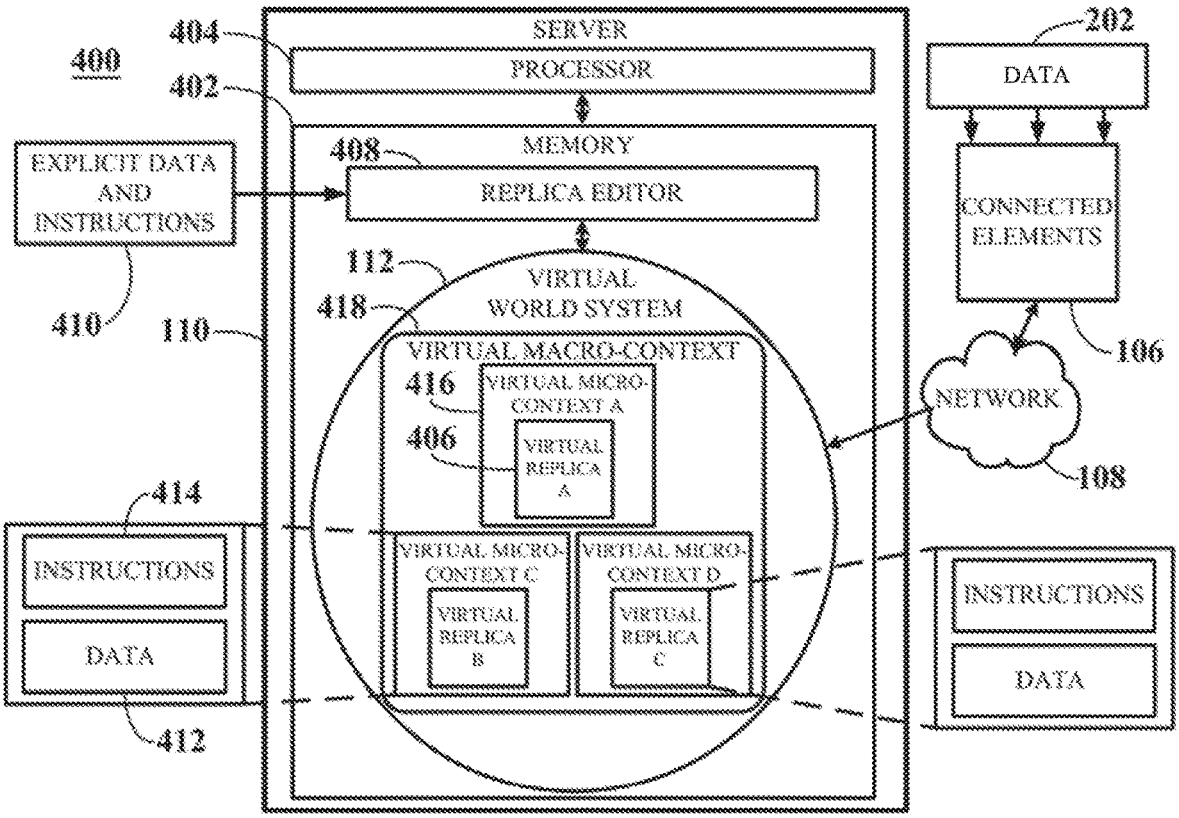
400
404
SERVER
PROCESSOR
402
MEMORY
408
REPLICA EDITOR
EXPLICIT DATA AND INSTRUCTIONS
410
110
112
418
VIRTUAL WORLD SYSTEM
VIRTUAL MACRO-CONTEXT
416
VIRTUAL MICRO-CONTEXT A
406
VIRTUAL REPLICA A
VIRTUAL MICRO-CONTEXT C
VIRTUAL REPLICA B
VIRTUAL MICRO-CONTEXT D
VIRTUAL REPLICA C
414
INSTRUCTIONS
DATA
412
202
DATA
CONNECTED ELEMENTS
106
NETWORK
108
INSTRUCTIONS
DATA

FIG. 4

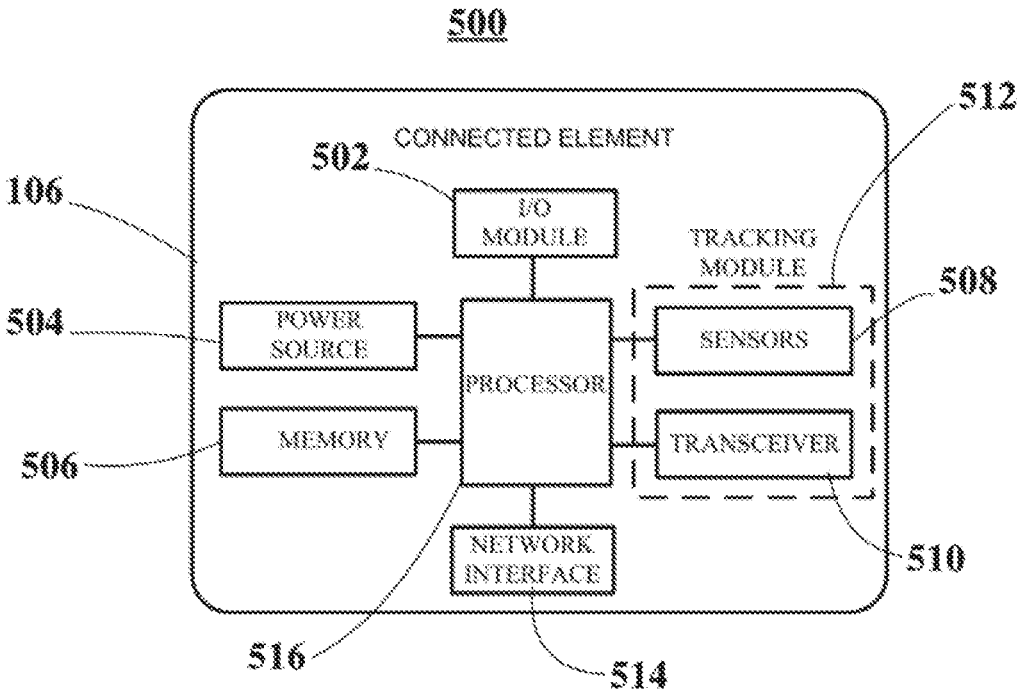
500
512
CONNECTED ELEMENT
502
106
I/O MODULE
TRACKING MODULE
508
504
POWER SOURCE
PROCESSOR
SENSORS
MEMORY
TRANSCEIVER
506
NETWORK INTERFACE
510
516
514

FIG. 5

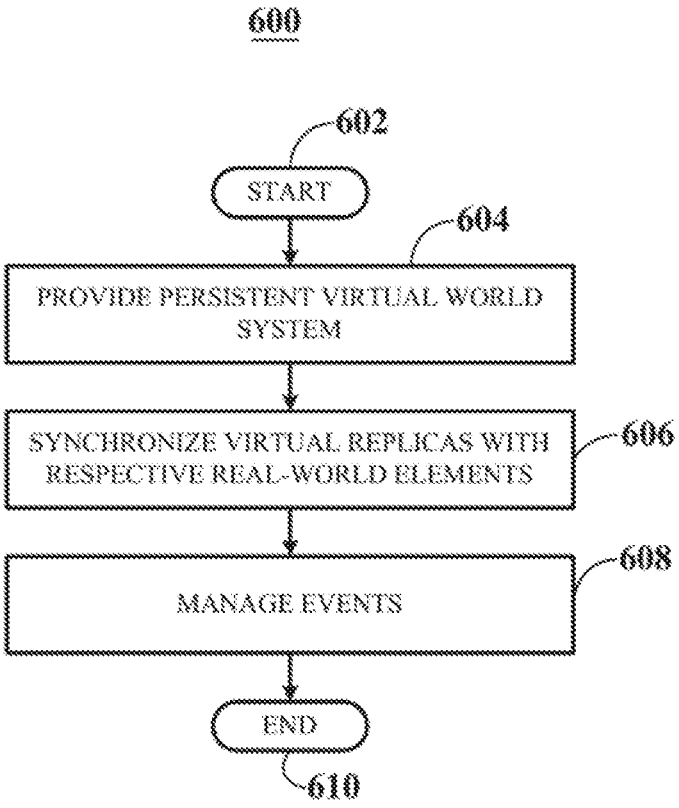
600
602
START
604
PROVIDE PERSISTENT VIRTUAL WORLD SYSTEM
SYNCHRONIZE VIRTUAL REPLICAS WITH RESPECTIVE REAL-WORLD ELEMENTS
606
MANAGE EVENTS
608
END
610

FIG. 6

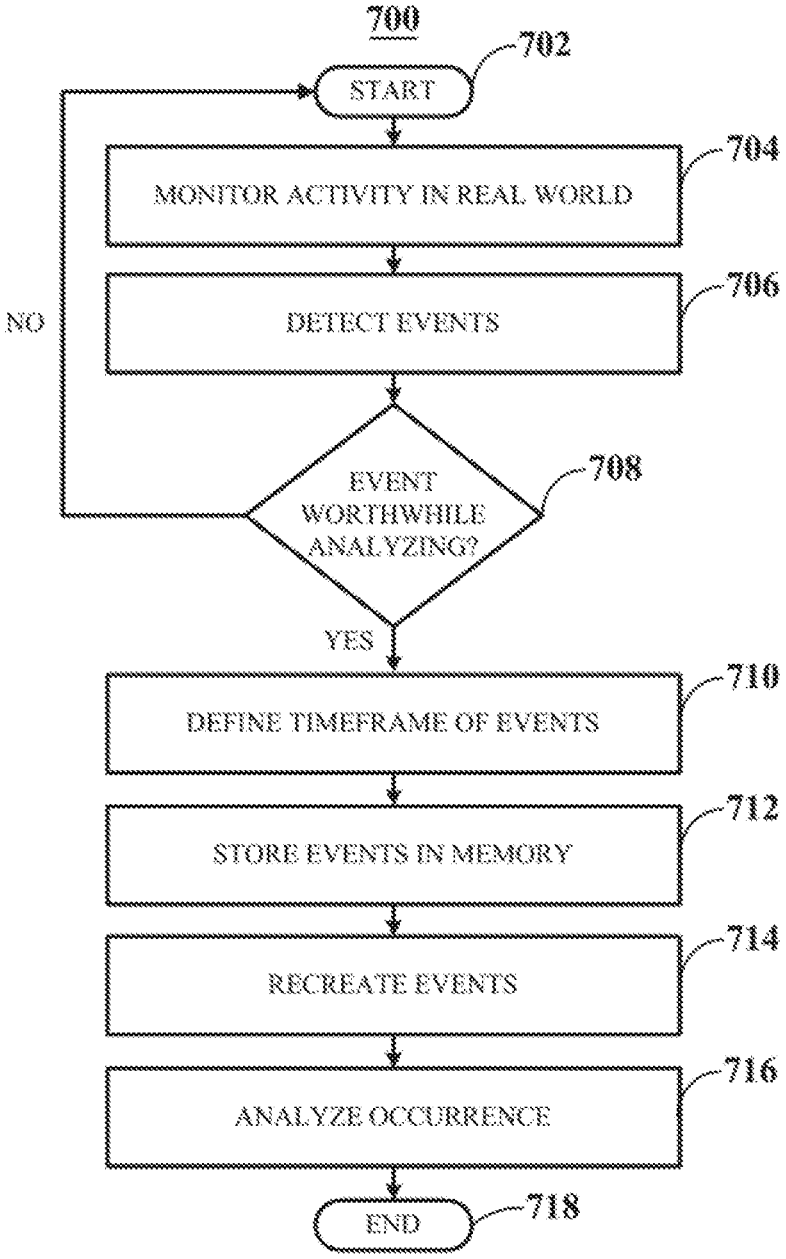
700
702
START
704
MONITOR ACTIVITY IN REAL WORLD
706
DETECT EVENTS
NO
708
EVENT WORTHWHILE ANALYZING?
YES
710
DEFINE TIMEFRAME OF EVENTS
712
STORE EVENTS IN MEMORY
714
RECREATE EVENTS
716
ANALYZE OCCURRENCE
718
END

FIG. 7

LIVE MANAGEMENT OF REAL WORLD VIA A PERSISTENT VIRTUAL WORLD SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of Provisional Application No. 62/852,197, filed May 23, 2019, the entire disclosure of which is hereby incorporated by reference herein for all purposes.

FIELD

The present disclosure generally relates to computer systems, and more specifically to a system and method that enable live management of events in the real world via a persistent virtual world system.

BACKGROUND

A virtual world is a simulated environment providing a graphical and physical representation of either a real or imaginary world, where users can interact with each other or with other elements via avatars. Virtual worlds are used, for example, in the creation of video games, animated films or to train pilots in a flight simulation. In all these applications, programs are used to render features that interact, move, and change based on user-inputs or programmed/learned behaviors.

Objects in the virtual world may follow rules related to gravity, topography, locomotion, physics and kinematics, which may or may not be based on real-world elements. As such, current techniques exist for creating a virtual replica of a real-world item. However, these virtual replicas often do not contain all the data of the real-world element and the context around them. Moreover, the replicas are typically not synchronized with their real-world counterpart to reflect changes made in the real-world. This limits the ability to employ the virtual world for significant applications such as management of buildings, factories, and cities, as well as for identifying anomalies in those environments. For example, in order to track accidents that may take place on the road, factories, homes, etc., it is usually necessary to go through hours of footage in order to identify the right moment where the accident took place.

Therefore, improvements in the way that virtual replicas of real-world elements are generated and synchronized are desired.

SUMMARY

This summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This summary is not intended to identify key features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

One or more drawbacks described in the background are addressed through systems and methods of the current disclosure, which enable the management of events occurring in the real world via a persistent virtual world system stored in the memory of a server. In the current disclosure, the term "events" refers to activities taking place in the real world which may be simulated in real-time via the persistent virtual world system. Events may be determined by computer logic under a plurality of criteria that can be defined within value thresholds. Events can be classified into ordinary events and extraordinary events. Ordinary events relate to activities that fall within predetermined standard parameter values, while extraordinary events refer to events that fall out of the predetermined parameter values.

A system of the current disclosure comprises a server system comprising one or more server computers, each server computer including memory and at least one processor, the server system including a database with structured data storing a persistent virtual world system comprising virtual replicas of real-world elements; and a plurality of connected elements connected to the server via a network, each connected element comprising communication circuitry and one or more sensing mechanisms configured to capture data from one or more of the real-world elements, thereby enabling a real-world and persistent virtual world system synchronization. The server system is configured to synchronize the persistent virtual world system with the real-world elements using the dynamic data captured by the connected elements and static data, and to enable live management of events in the real world through the synchronized persistent virtual world system.

According to an embodiment, the connected elements are one or more mobile phones, laptops, wearable computers, mobile game consoles, head-mounted displays, see-through devices, smart contact lenses, surveillance cameras, vehicles, traffic lights, buildings, streets, train-tracks, home appliances, or any other device that may be connected to a network. According to an embodiment, the plurality of sensing mechanisms mounted on the connected elements include one or more temperature sensors, proximity sensors, inertial sensors, infrared sensors, pollution sensors (e.g., gas sensors), pressure sensors, light sensors, ultrasonic sensors, smoke sensors, touch sensors, chromatic sensors, humidity sensors, water sensors, electrical sensors, or combinations thereof.

In some embodiments, management of events in the real world comprises one or more of the steps of monitoring activity in the real world through the persistent virtual world system; detecting the events, wherein the events are defined within pre-determined parameter values that are compared with the real values of activities in the real world; and checking whether events fall within one or more predetermined analysis requirement parameters; wherein the checking step comprises, in a negative case where an event falls outside the one or more predetermined analysis requirement parameters, continuing to monitor activity in the real world, and in a positive case where the event falls within the one or more predetermined analysis requirement parameters, the process continues by defining the timeframe of events; storing the events in the memory; recreating the events; and analyzing the events.

In various embodiments, monitoring of events may be performed through the plurality of sensing mechanisms on the plurality of connected elements connected to the server via the network, and may comprise a passive observation of activity taking place in the real world.

Detecting events may be performed by comparing the real values of activities taking place in the real world with predetermined standard value ranges linked to the event. In yet other embodiments, detecting events further comprises classifying the events into ordinary or extraordinary events.

Recreating the events may be performed by generating event data points comprising data gathered within the duration of events, generating simulation data corresponding to duration of the events, or combinations thereof. In some embodiments, recreating of events further comprises replay-

ing events and experiences related to the events in digital realities (e.g., augmented reality, or virtual reality, or combinations thereof).

Analyzing the events may be performed by applying statistical and/or logical algorithms to describe, condense and evaluate the events. Analysis of events may be performed automatically by artificial intelligence algorithms or may involve human interaction.

According to an embodiment, recreating events in digital realities may provide event analyzers with context-rich 3D images and experiences of the events, which may be helpful during event analysis. In some embodiments, the events may be reviewed and analyzed from different perspectives. In other embodiments, recreating events may also provide other types of experiences created during generation of event data points, including simulations with audio data, haptic data, motion data, connected element or system data (like vehicular telemetry, drone telemetry) textual data (e.g., subtitles, comments, annotations, etc.), etc.

According to an embodiment, management of events further comprises operation of the events through artificial intelligence algorithms or user input. Operation of events may be performed as a result of the analysis of the events. Operation of events may trigger one or more actions on one or more real-world elements through their respective virtual replicas in the persistent virtual world system. In some embodiments, operations of events may be influenced by whether the events are ordinary or extraordinary events.

According to an embodiment, management of events comprises sharing stored events with one or more users, e.g., through the server system or one or more other servers through the network. Sharing of events may be performed in order to perform further analysis of the events, further operations, or combinations thereof.

According to an embodiment, occurrence of events has an effect on the context around the events, triggering other events in the real world through the persistent virtual world system that comprise interactions between one or more real-world elements within the affected context. Such effects on the context of events may trigger further operations of real-world elements, which can provide further data for analysis of the events.

In some embodiments, the persistent virtual world system comprises a virtual 3D infrastructure including one or more virtual replicas, purely virtual objects, virtual corridors, and digital reality applications, or combinations thereof enabling spatial organization, behaviors, computational and logical interactions between each other and with elements of the real world through their corresponding virtual replicas. The virtual corridors of the virtual 3D infrastructure can serve to define and delimit the path of real objects through their virtual replicas, purely virtual objects, or digital reality applications.

According to an embodiment, the data used for synchronizing virtual replicas with the respective real-world elements comprises capturable data of real-world elements. The data comprises, for example, one or more of 3D image data, 3D geometries, 3D entities, 3D sensory data, 3D dynamic objects, video data, audio data, priority data, chemical composition, waste production data, textual data, time data, positional data, orientational data, velocity data, temperature data, humidity data, pollution data, lighting data, volume data, flow data, chromatic data, power consumption data, bandwidth data, and mass data, amongst others. In some embodiments, the static data includes data that is not likely to change, such as the location, position and orientation of static objects, such as buildings and internal elements, monuments, parks, natural structures, etc. In other embodiments, the dynamic data includes data that is periodically updated, meaning that it may change asynchronously over time as new information becomes available. For example, dynamic data may include the position and orientation of moving objects, such as vehicles, or other data that may change over time, such as temperature, pressure, humidity, etc.

In some embodiments, the data used for synchronizing virtual replicas further includes contextual data, which can be classified into micro-context immediately affecting a real-world element, and macro-context derived from a plurality of micro-contexts. In further embodiments, the micro-context further includes 3D image data, 3D geometries, 3D entities, 3D dynamic objects, video data, audio data, textual data, time data, metadata, priority data, security data, positional data, lighting data, temperature data, quality of service (QOS), and service context of the environment immediately surrounding and affecting a target real-world element. In further embodiments, the macro-context further comprises holistic information of a system including current efficiency of a manufacturing plant, air quality, climate change levels, company efficiency, city efficiency, country efficiency, and worldwide efficiency.

In some embodiments, the persistent virtual world system is structured by layers, where outer layers comprise inner layers. The outer layers may represent higher-level entities, and the inner layers may represent lower-level, more in-depth entities. For example, an outer layer may represent a country, which may be composed of several cities, each city representing an inner layer of the country. Each city, on the other hand, may include several districts, each district representing an inner layer of the city. The districts may include several neighborhoods, each neighborhood representing an inner layer of the district. Each neighborhood may include several houses, stores, and factories, for example, each of these elements representing an inner layer of the neighborhood. Finally, each of these inner layer elements of the neighborhood may also include connected elements with sensing mechanisms configured to obtain real-time data that enriches and updates the virtual replicas.

In some embodiments, event management may be implemented by layers. For example, a human or artificial intelligence administrator at a district level may be responsible for monitoring a district, and may be in charge of analyzing occurrences therein in order to generate one or more operation instructions derived from the event analysis. In other examples, a human or artificial intelligence administrator at a city level may be responsible for monitoring a city, and may be in charge of analyzing occurrences therein to generate one or more operation instructions derived from the event analysis.

According to an embodiment, a method enabling live management of events in the real world through a persistent virtual world system comprises the steps of providing in the memory of a server system a database with structured data storing a persistent virtual world system comprising virtual replicas of real-world elements; synchronizing the virtual replicas with the respective real-world elements using dynamic data and static data from a plurality of connected elements connected to the server via a network, the connected elements comprising sensing mechanisms configured to capture the dynamic data from the real-world elements; and managing events in the real world through the synchronized persistent virtual world system.

According to an embodiment, a method for live management of events comprises one or more of the steps of

monitoring activity in the real world through persistent virtual world system; detecting the events, wherein the events are defined within pre-determined parameter values that are compared with the real values of activities in the real world; and checking whether events fall within one or more predetermined analysis requirement parameters; wherein the checking step comprises, in a negative case where an event falls outside the one or more predetermined analysis requirement parameters, continuing to monitor activity in the real world, and in a positive case where the event falls within the one or more predetermined analysis requirement parameters, the process continues by: defining timeframe of events; storing the events in the memory; recreating the events; and analyzing the events.

According to an embodiment, a non-transitory computer readable medium storing a program configured to cause one or more processors to perform steps comprising providing a database with structured data storing a persistent virtual world system comprising virtual replicas of real-world elements; synchronizing the virtual replicas with the respective real-world elements using dynamic and static data obtained from a plurality of connected elements connected to a server via a network, the connected elements comprising sensing mechanisms configured to capture the dynamic data from the real-world elements; and managing events in the real world through the synchronized persistent virtual world system.

According to an embodiment, instructions recorded in the non-transitory computer-readable medium enabling management of events cause a processor to execute a process comprising monitoring activity in the real world through the persistent virtual world system; detecting the events, wherein the events are defined within pre-determined parameter values that are compared with the real values of activities in the real world; and checking whether events fall within one or more predetermined analysis requirement parameters; wherein the checking step comprises, in a negative case where an event falls outside the one or more predetermined analysis requirement parameters, continuing to monitor activity in the real world, and in a positive case where the event falls within the one or more predetermined analysis requirement parameters, the process continues by: defining timeframe of events; storing the events in the memory; recreating the events; and analyzing the events.

The above summary does not include an exhaustive list of all aspects of the present disclosure. It is contemplated that the disclosure includes all systems and methods that can be practiced from all suitable combinations of the various aspects summarized above, as well as those disclosed in the Detailed Description below, and particularly pointed out in the claims filed with the application. Such combinations have particular advantages not specifically recited in the above summary. Other features and advantages will be apparent from the accompanying drawings and from the detailed description that follows below.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing aspects and many of the attendant advantages will become more readily appreciated as the same become better understood by reference to the following detailed description, when taken in conjunction with the accompanying drawings, wherein:

FIG. **1** depicts a schematic representation of a system enabling live management of events in the real world through a persistent virtual world, according to an embodiment;

FIG. **2** depicts a schematic representation detailing the capture of data that is used to enrich and synchronize a persistent virtual world system, according to an embodiment;

FIG. **3** depicts a schematic representation of layers of a persistent virtual world system, according to an embodiment;

FIG. **4** depicts a schematic representation of a system detailing the relation of a server with connected elements of the real world;

FIG. **5** depicts a schematic representation of a connected element, according to an embodiment;

FIG. **6** depicts a block diagram of a method enabling live management of events in the real world through a persistent virtual world, according to an embodiment;

FIG. **7** depicts a block diagram detailing further steps of the method enabling management of events in the real world through a persistent virtual world system, according to an embodiment.

DETAILED DESCRIPTION

In the following description, reference is made to drawings which show by way of illustration various embodiments. Also, various embodiments will be described below by referring to several examples. It is to be understood that the embodiments may include changes in design and structure without departing from the scope of the claimed subject matter.

FIG. **1** depicts a schematic representation of a system **100** enabling live management of events in the real world through a persistent virtual world, according to an embodiment. System **100** includes static data **102** and dynamic data **104**, which may be captured from real-world elements by sensing mechanisms implemented on connected elements **106**. The connected elements **106** send via a network **108**, e.g., in real-time, the static data **102** and dynamic data **104** to a server **110** storing a persistent virtual world system **112**. Although references are made herein to a single server, it should be understood that the persistent virtual world system **112** or other features described herein may be implemented in or performed by a server system comprising one or more server computers.

In the current disclosure, the term "persistent" is used to characterize a state of a system that can continue to exist without a continuously executing process or network connection. For example, the term "persistent" may be used to characterize the virtual world system where the virtual world system and all of the virtual replicas, purely virtual objects and digital reality applications therein comprised continue to exist after the processes used for creating the virtual replicas, purely virtual objects and digital reality applications cease, and independent of users being connected to the virtual world system. Thus, the virtual world system is saved in a non-volatile storage location, e.g., in the server **110**. In this way, virtual replicas, purely virtual objects and digital reality applications may interact and collaborate with each other when being configured for accomplishing specific goals even if users are not connected to the server.

In the current disclosure, the term "events" refers to activities taking place in the real world which may be simulated in real-time via the persistent virtual world system. Events may be determined by computer logic under a plurality of criteria that can be defined within value thresholds. Events can be classified into ordinary events and extraordinary events. Ordinary events relate to activities that fall within predetermined standard parameter values, while

extraordinary events refer to events that fall out of the predetermined parameter values. For example, an ordinary event can be moving traffic, a payment transaction or playing a sport, while an extraordinary event may refer to a car accident, a potential ID/money theft during a payment transaction, or a foul/accident during a game. Due to the synchronization of real-world elements with their respective virtual replicas, events can be updated in real-time in the persistent virtual world system, which can serve during the management of the events. In some embodiments, events are generated by artificial intelligence algorithms, user-input, or combinations thereof. In other embodiments, events can be further affected by natural occurrences, such as by weather, force majeure events (e.g., earthquakes, lightning, floods, etc.), and the like.

According to an embodiment, the data obtained from connected elements comprises capturable data of each real-world element, comprising one or more of 3D image data, 3D geometries, 3D entities, 3D dynamic objects, video data, audio data, priority data, chemical composition, waste production data, textual data, time data, positional data, orientational data, velocity data, temperature data, humidity data, pollution data, lighting data, volume data, flow data, chromatic data, power consumption data, bandwidth data, telemetry data (e.g., vehicular telemetry data and device telemetry data) and mass data, amongst others.

In some embodiments, the static data **102** includes data that is not likely to change, such as the location, position and orientation of static objects, such as buildings and internal elements, monuments, parks, natural structures, etc. In other embodiments, the dynamic data **104** includes data that is periodically updated, meaning that it may change asynchronously over time as new information becomes available. For example, dynamic data **104** may include the position and orientation of moving objects, such as vehicles, or other data that may change over time, such as temperature, pressure, humidity, etc.

In some embodiments, the network **108** may be, for example, a cellular network and may employ various technologies including enhanced data rates for global evolution (EDGE), general packet radio service (GPRS), global system for mobile communications (GSM), Internet protocol multimedia subsystem (IMS), universal mobile telecommunications system (UMTS), etc., as well as any other suitable wireless medium, e.g., microwave access (WiMAX), Long Term Evolution (LTE) networks, code division multiple access (CDMA), wideband code division multiple access (WCDMA), and wireless fidelity (WiFi), satellite, mobile ad-hoc network (MANET), and the like.

In an embodiment, in order to reduce hardware and network demands, contribute to the reduction of network latency, and improve the general digital reality experience, the system may connect through a network including millimeter-wave (mmW) or combinations of mmW and sub 6 GHz communication systems, such as through 5^{th} generation wireless systems communication (5G). In other embodiments, the system may connect through a wireless local area networking (Wi-Fi) providing data at, e.g., 60 GHz. Provided communication systems may allow for low (e.g., about 1 to about 5 milliseconds) end-to-end (E2E) latency and high (e.g., 1-10) Gbps downlink speeds to end points in the field, complying with parameters necessary for executing the typically highly-interactive digital reality applications. This results in high-quality, low latency, real-time digital application content streaming. In other embodiments, the system may communicatively connect through 4th generation wireless systems communication (4G), may be supported by 4G communication systems, or may include other wired or wireless communication systems.

In other embodiments, global navigation satellite systems (GNSS), which refers collectively to multiple satellite-based navigation systems like GPS, BDS, Glonass, QZSS, Galileo, and IRNSS, may be used for enabling positioning of devices. Employing signals from a sufficient number of satellites and techniques such as triangulation and trilateration, GNSS can calculate the position, velocity, altitude, and time of devices. In a preferred embodiment, the external positioning system is augmented by assisted GNSS (AGNSS) through the architecture of existing cellular communications network, wherein the existing architecture comprises 5G. In other embodiments, the AGNSS tracking system is further supported by a 4G cellular communications network. In indoor embodiments, the GNSS is further augmented via radio wireless local area networks such as Wi-Fi, preferably, but not limited to, providing data at 60 GHz. In alternative embodiments, the GNSS is augmented via other techniques known in the art, such as via differential GPS (DGPS), satellite-based augmentation systems (SBASs), real-time kinematic (RTK) systems. In some embodiments, tracking of devices is implemented by a combination of AGNSS and inertial sensors in the devices.

FIG. **2** depicts a schematic representation of a system **200** detailing the capture of data that is used to enrich and synchronize a persistent virtual world system, according to an embodiment. Some elements of FIG. **2** may be similar to elements of FIG. **1**, and thus similar or identical reference numerals may be used to depict those elements.

System **200** includes a server **110** connected via a network **108** to a plurality of connected elements **106** capturing data **202** via various sensing mechanisms. The plurality of sensing mechanisms mounted on the connected elements **106** capture data **202** from themselves and from the context related to each connected element **106**, including any real-world element. Accordingly, each real-world element may or may not be a connected element **106**. For example, a building may be both a connected element **106** and a real-world element, while a tree may only represent a real-world element but not a connected element **106** because, for example, no devices configured to capture or transmit data **202** may be connected to the tree. The data **202** is transferred (e.g., in real-time) to the persistent virtual world system **112** stored in the server **110**.

The plurality of connected elements **106** may include one or more mobile phones, laptops, wearable computers, personal computers, mobile game consoles, head-mounted displays, see-through devices, surveillance cameras, vehicles, traffic lights, buildings and other structures, streets, train-tracks, home appliances, or any other device that may be connected via a network **108**. According to an embodiment, the plurality of sensing mechanisms mounted on the connected elements **106** include one or more temperature sensors, proximity sensors, inertial sensors, infrared sensors, pollution sensors (e.g., gas sensors), pressure sensors, light sensors, ultrasonic sensors, smoke sensors, touch sensors, chromatic sensors, humidity sensors, water sensors, electrical sensors, or combinations thereof.

Although FIG. **2** shows one server **110**, it may be understood that more than one server **110** in one or more locations may be used to serve a complex system comprising a plurality of connected elements **106** located in various locations. Thus, the plurality of connected elements **106** may be connected to the one or more servers **110** depending on the location of the connected elements **106** at a specific point in time. Moreover, the plurality of connected elements **106**,

as shown in FIG. **2**, may be connected to a server **110** and at the same time may also connect to each other via the network **108**.

The data **202** includes capturable data of each real-world element, including 3D image data, 3D geometries, 3D entities, 3D dynamic objects, 3d avatars of users, objects and buildings, video data, audio data, priority data, chemical composition, waste production data, textual data, time data, positional data, orientational data, velocity data, temperature data, humidity data, pollution data, lighting data, volume data, flow data, color data, power consumption data, bandwidth data, mass data, or any other data that may be captured by sensing mechanisms. The plurality of sensing mechanisms captures, apart from data corresponding directly to each real-world element, contextual data from the surrounding environment, which may be classified as micro-context **204** and macro-context **206**.

The term "real-world element", as used in the current disclosure, refers to elements found in the real world having physical properties which may be sensed by sensing mechanisms. The real-world elements may be moving or static entities found in the real world, including human beings, vehicles, buildings, objects, recreation areas, natural formations, streets, and any other element that may be found in the real world. Real-world element data captured by sensing mechanisms of connected elements **106** may be extracted from 3D image data, 3D geometries, video data, audio data, temperature data, mass data, radiation data, haptic data, motion data, or any other capturable data that may be obtained by sensing mechanisms. As such, the real-world elements themselves may include sensing mechanisms and may themselves capture data **202**. Thus, to the perception of other connected elements **106**, other connected elements **106** may also be categorized as real-world elements.

The term "context" or "contextual data", as used in the current disclosure, refers to data related to the direct or indirect environment of a specific real-world element, which may be classified as "micro-context" and "macro-context".

The term "micro-context" refers to the context immediately surrounding a real-world element, such as people, objects, or conditions that may directly affect the real-world element. Micro-context **204** may include data such as 3D image data, 3D geometries, 3D entities, 3D dynamic objects, video data, audio data, textual data, time data, metadata, priority data, security data, positional data, lighting data, temperature data, and quality of service (QOS), amongst others, of the environment immediately surrounding and affecting a target real-world element. In an embodiment, the micro-context **204** also includes service context, which refers to the actual applications used being used by a user or users in the vicinity. As each application consumes bandwidth, service context may provide the system **200** with valuable context information required to assess provisioning of network signals to each connected elements **106**.

The term "macro-context" refers to the indirect or more distant context surrounding a real-world element. The macro context may be derived by the server **110** from a plurality of micro-context **204**, giving rise to more holistic information of a system, such as the current efficiency of a manufacturing plant, air quality, climate change levels, company efficiency, city efficiency, country efficiency, etc. The macro context may be considered and computed at different levels including local level (e.g., office or manufacturing plant), neighborhood level, city level, country level, or even planet level. Thus, the same real-world element data and micro context data may derive different types of macro-contexts **206**.

FIG. **3** depicts a schematic representation of layers of a persistent virtual world system **112**, according to an embodiment. Some elements of FIG. **3** may be similar to elements of FIGS. **1-2**, and thus similar or identical reference numerals may be used to depict those elements.

In some embodiments, the persistent virtual world system **112** stored in the server **110** is structured by layers **302**, wherein outer layers define broad geographical areas and inner layers define smaller geographical areas within the outer layers, and wherein event management is implemented by layers. The outer layers may represent higher-level entities, and the inner layers may represent lower-level entities. For example, an outer layer may represent a country **304**, which may be comprised of several cities **306**, each city **306** representing an inner layer of the country **304**. Each city **306**, on the other hand, may include several districts **308**, each district **308** representing an inner layer of the city **306**. The districts may include several neighborhoods **310**, each neighborhood **310** representing an inner layer of the district **308**. Each neighborhood may include several houses **312**, stores **314**, factories **316**, and others **318**, each of these elements representing an inner layer of the neighborhood **310**. Finally, each of these inner layer elements of the neighborhood **310** may also include connected elements **106** with sensing mechanisms configured to obtain real-time data that enriches and updates the virtual replicas of the persistent virtual world system **112**.

FIG. **4** depicts a schematic representation of a system **400** detailing the relation of a server with connected elements of the real world. Some elements of FIG. **4** may be similar to elements of FIGS. **1-3**, and thus similar or identical reference numerals may be used to depict those elements.

A system **400** of the current disclosure includes at least one server **110** and a plurality of connected elements **106** connected to the at least one server **110** via a network **108**. The server **110** includes a memory **402** and at least one processor **404**. The memory **402** stores a database with structured data storing persistent virtual world system **112** comprising a plurality of virtual replicas **406**, such as virtual replicas **406** A, B, and C, corresponding to respective real-world elements. The virtual replicas **406** communicatively connect to the real-world elements through sensing mechanisms attached to a plurality of devices connected to the server **110** via a network **108**. The sensing mechanisms provide the virtual replicas **406** with data **202** enabling real-world and persistent virtual world system **112** synchronization. The at least one processor **404** is configured to enable live management of events in the real world through the synchronized persistent virtual world system **112**.

Some of the virtual replicas **406**, namely the virtual replicas **406** of real world elements that do not include any sensing mechanisms (i.e., natural formations, vehicles that cannot connect to a network, buildings that are not connected to a network, new elements that are not yet connected to the at least one server **110**, etc.), may only appear graphically in the persistent virtual world system **112** and may only be updated visually through optical sensors, such as cameras or scanners, attached to other connected elements **106**.

In some embodiments, a virtual replica includes one or more of 3D world and building data, such as SLAM or derivate-mapping based data; 3D geometry data; 3D point cloud data; or geographic information system data representing real-world structural properties that may serve to model a 3D structure for digital reality applications.

In some embodiments, the persistent virtual world system **112** comprises a virtual 3D infrastructure including one or

more virtual replicas **406**, purely virtual objects, virtual corridors, and digital reality applications, or combinations thereof enabling spatial organization, behaviors, computational and logical interactions between each other and with elements of the real world through their corresponding virtual replicas. The virtual corridors of the virtual 3D infrastructure can serve to define and delimit the path of real objects through their virtual replicas, purely virtual objects, or digital reality applications. For example, a virtual corridor can be used for delimiting the flight-path of a drone or airplane by servicing the flight-path as a virtual corridor, which can be accessed and processed through the respective virtual replicas.

The at least one server **110** may provide computing resources sufficient to carry out heavy load applications, such as servicing, distributing, computing, streaming, and/or rendering digital content from one or more digital reality applications for interaction with users. In preferred embodiments, the computing environment of the servers **110** is run on an abstracted, virtualized infrastructure that shares resources such as CPU, memory and storage between applications, such as in cloud servers. Using a cloud computing network, access to computing power, computer infrastructure (e.g., through so-called infrastructure as a service, or IaaS), applications, and business processes can be delivered as a service to users on demand.

According to an embodiment, the memory **402** further includes a replica editor **408** which may include software and hardware configured to enable users to model and edit the virtual replicas **406** of the real world entities. The replica editor **408** may be, for example, computer-aided drawing (CAD) software that may store data and instructions necessary to input and edit virtual replicas **406**. The replica editor **408** may enable the input of explicit data and instructions **410** that relate to each digital replica, which refers to data and instructions that describe the shape, location, position and orientation, or other properties, and the expected functioning and impact of each virtual replica **406** and the persistent virtual world system **112** as a whole.

"Explicit data" refers herein to data that may not be obtained by the sensing mechanisms but which may instead need to be input digitally through the replica editor **408**, such as priority data, building materials, wall thicknesses, electric installations and circuitry, water pipes, fire extinguishers, emergency exits, window locations, machine performance parameters, machine sensor and valve locations, etc. "Priority data", as used herein, refers to a hierarchical classification of real world entities. For example, certain vehicles (e.g., ambulances) or people (e.g., presidents, government officials, police officers, etc.) may have higher priorities which may affect the decisions performed based on data inference. The term "instructions", as used herein, refers to code (e.g., binary code) that is configured to be executed by a processor. In the context of a virtual replica **406**, instructions may refer to code that represents the behavior of the real-world element.

Modeling techniques for converting real world entities into virtual replicas **406** with explicit data and instructions **410** and make them available in the persistent virtual world system **112** may be based on readily-available CAD models of the real world entities. For example, machine owners may provide an administrator of the persistent virtual world system **112** or may input by themselves the already-existing digital CAD models of their machines. Similarly, building owners may provide building information models (BIM) with building details to be stored in the persistent virtual world system **112**, which may include information that may not be visible or easily obtainable via sensing mechanism. In these embodiments, the owners of these real world entities may be responsible for adding the virtual replicas into the persistent virtual world system **112**, which may be achieved, for example, through incentive systems or by legal requirements. In some embodiments, the administrators of the persistent virtual world system **112**, and even government officials, may collaborate with owners of real world entities for inputting the real world entities into the persistent virtual world system **112** and therefore realizing a faster and more thorough creation of the persistent virtual world system **112**.

In other embodiments, radar-imaging, such as synthetic-aperture radars, real-aperture radars, Light Detection and Ranging (LIDAR), inverse aperture radars, monopulse radars, and other types of imaging techniques may be used to map and model real world entities before integrating them into the persistent virtual world system **112**. Utilizing these more technical solutions may be performed especially in cases where the original models of the structures are not available, or in cases where there is missing information or there is a need to add additional information to the virtual world entities which is not provided by the CAD models.

Independent of the modeling techniques used for creating the virtual replicas **406**, the information of each virtual replica **406** should provide enough details about each corresponding real-world element so that a highly accurate virtual replica **406** of each real-world element is available. The virtual replicas **406** are then enriched and updated through the data **202**. Thus, virtual replicas **406** include data **412** and instructions **414** that serve to describe the real appearance and behavior of each real-world element, unless referring to virtual replicas **406** of unconnected elements that may only provide their respective real appearance and no data and instructions regarding their functionality.

As described with respect to FIG. **2**, the data **202** may also include contextual data, such as micro-context **204** including micro-context A, B, and C, and macro-context **206**. This same data is then transferred to the persistent virtual world system **112** to become, respectively, a virtual micro-context **416** including virtual micro-context A, B, and C, and a virtual macro-context **418**, which are updated in real-time based on the data **202** obtained by sensing mechanisms of the connected elements **106**. The virtual micro-context **416** and virtual macro-context **418** also include data **412** and instructions **414** that serve to describe the respective real-world appearance and behavior.

FIG. **5** depicts a schematic representation of a system **500** depicts a schematic representation of a connected element, according to an embodiment. Some elements of FIG. **5** may be similar to elements of FIGS. **1-4**, and thus similar or identical reference numerals may be used to depict those elements.

A connected element **106** may include operational components such as an input/output (I/O) module **502**; a power source **504**; a memory **506**; sensing mechanisms **508** and transceivers **510** forming a tracking module **512**; and communication circuitry such as a network interface **514**, all operatively connected to a processor **516**.

The I/O module **502** is implemented as computing hardware and software configured to interact with users and provide user input data to one or more other system components. For example, I/O module **502** may be configured to interact with users, generate user input data based on the interaction, and provide the user input data to the processor **516** before being transferred to other processing systems via a network, such as to a server. In another example, I/O modules **502** is implemented as an external computing

pointing device (e.g., a touch screen, mouse, 3D control, joystick, gamepad, and the like) and/or text entry device (e.g., a keyboard, dictation tool, and the like) configured to interact with other connected elements **106**. In yet other embodiments, I/O module **502** may provide additional, fewer, or different functionality to that described above.

The power source **504** is implemented as computing hardware and software configured to provide power to the connected elements **106**. In one embodiment, the power source **504** may be a battery. The power source **504** may be built into the devices or removable from the devices, and may be rechargeable or non-rechargeable. In one embodiment, the devices may be repowered by replacing one power source **504** with another power source **504**. In another embodiment, the power source **504** may be recharged by a cable attached to a charging source, such as a universal serial bus ("USB") FireWire, Ethernet, Thunderbolt, or headphone cable, attached to a personal computer. In yet another embodiment, the power source **504** may be recharged by inductive charging, wherein an electromagnetic field is used to transfer energy from an inductive charger to the power source **504** when the two are brought in close proximity, but need not be plugged into one another via a cable. In another embodiment, a docking station may be used to facilitate charging.

The memory **506** may be implemented as computing hardware and software adapted to store application program instructions and to store data captured by the plurality of sensing mechanisms. The memory **506** may be of any suitable type capable of storing information accessible by the processor **516**, including a computer-readable medium, or other medium that stores data that may be read with the aid of an electronic device, such as a hard-drive, memory card, flash drive, ROM, RAM, DVD or other optical disks, as well as other write-capable and read-only memories. The memory **506** may include temporary storage in addition to persistent storage.

The sensing mechanisms may be implemented as computing hardware and software adapted to obtain various data from the real world and determine/track the position and orientation of the connected elements **106**. The sensing mechanisms may include, without limitations, one or more temperature sensors, proximity sensors, inertial sensors, infrared sensors, pollution sensors (e.g., gas sensors), pressure sensors, light sensors, ultrasonic sensors, smoke sensors, touch sensors, chromatic sensors, humidity sensors, water sensors, electrical sensors, or combinations thereof. In particular, the sensing mechanisms include one or more Inertia Measuring Units (IMUs), accelerometers, and gyroscopes. The IMU is configured to measure and report the velocity, acceleration, angular momentum, speed of translation, speed of rotation, and other telemetry metadata of connected elements **106** by using a combination of accelerometers and gyroscopes. Accelerometers within the IMU and/or configured separate from the IMU may be configured to measure the acceleration of the interaction device, including the acceleration due to the Earth's gravitational field. In one embodiment, accelerometers include a tri-axial accelerometer that is capable of measuring acceleration in three orthogonal directions.

The transceivers **510** may be implemented as computing hardware and software configured to enable devices to receive wireless radio waves from antennas and to send the data back to the antennas. In some embodiments, mmW transceivers may be employed, which may be configured to receive mmW wave signals from antennas and to send the data back to antennas when interacting with immersive content. The transceiver **510** may be a two-way communication transceiver **510**.

According to an embodiment, the transceivers **510** enable direct communication between computing devices via a distributed ledger-based communications pipeline connected to a network. The distributed ledger-based communications pipeline may enable direct communication between connected elements **106** through a decentralized network by allowing storage of information in a secure and accurate manner using cryptography, employing cryptographic "keys" and cryptographic signatures. Situations that may require direct communication between connected elements **106**, and thus by-passing processing by a server, may include urgent situations in which decisions may need to be taken within a very short period of time. For example, in an autonomous driving case where two vehicles may be about to collide, it may be desired to enable a direct communication between both vehicles to generate a faster response that may prevent a collision. In other embodiments, the distributed ledger may also be utilized between server a connected elements **106**, where the server may take the authority to validate data before distributing it to each connected elements **106**. In further embodiments, the distributed ledger can make use of certain connected elements **106** closer to servers, to antennas, or both, in order to assign these connected elements **106** as central structures to validate and distribute data.

In an embodiment, the tracking module **512** may be implemented by combining the capabilities of the IMU, accelerometers, and gyroscopes with the positional tracking provided by the transceivers **510** and the accurate tracking, low-latency and high QOS functionalities provided by mmW-based antennas may enable sub-centimeter or sub-millimeter positional and orientational tracking, which may increase accuracy when tracking the real-time position and orientation of connected elements **106**. In alternative embodiments, the sensing mechanisms and transceivers **510** may be coupled together in a single tracking module device.

The network interface **514** may be implemented as computing software and hardware to communicatively connect to a network, receive computer readable program instructions from the network sent by the server or by other connected elements **106**, and forward the computer readable program instructions for storage in the memory **506** for execution by the processor **516**.

The processor **516** may be implemented as computing hardware and software configured to receive and process data. For example, the processor **516** may be configured to provide imaging requests, receive imaging data, process imaging data into environment or other data, process user input data and/or imaging data to generate user interaction data, perform edge-based (on-device) machine learning training and inference, provide server requests, receive server responses, and/or provide user interaction data, environment data, and content object data to one or more other system components. For example, the processor **516** may receive user input data from I/O module **502** and may respectively implement application programs stored in the memory **506**. In other examples, the processor **516** may receive data from sensing mechanisms captured from the real world, or may receive an accurate position and orientation of connected elements **106** through the tracking module **512**, and may prepare some of the data before sending the data to a server for further processing. As way of example, the processor **516** may realize some of the steps required during data preparation including analog or digital

signal processing algorithms such as raw data reduction or filtering of data before sending the data to a server.

FIG. **6** depicts a block diagram of a method **600** enabling live management of events in the real world through a persistent virtual world, according to an embodiment. Method **600** may be implemented by a system, such as systems shown with respect to FIGS. **1-5**.

The method **600** starts in blocks **602** and **604** by providing in the memory of a server a database with structured data storing a persistent virtual world system comprising virtual replicas of real-world elements. The method **600** continues in step **606** by synchronizing the virtual replicas with the respective real-world elements by using a plurality of connected elements connected to the server via a network, the connected elements comprising sensing mechanisms configured to capture data from the real-world elements. The method continues in step **608** by managing events in the real world through the synchronized persistent virtual world system, ending the process in step **610**.

FIG. **7** depicts a block diagram of a method **700** detailing further steps of the method **600** enabling management of events in the real world through a persistent virtual world system, according to an embodiment, as described in FIG. **6**. Method **700** may be implemented by a system, such as systems shown with respect to FIGS. **1-5**.

Management of events in the real world begins in steps **702** and **704** by monitoring activity in the real world through the persistent virtual world system. Monitoring of events may be performed through a plurality of sensing mechanisms on a plurality of connected elements connected to at least one server via a network (e.g., connected elements **106** of FIG. **1** connected to the at least one server **110** via the network **108**), and may comprise a passive observation of all activity taking place in the real world. For example, monitoring of events may refer to the behavior of traffic in a specific highway. The monitoring may be performed, for example, by a combination of cameras installed in various areas of the highway, speed sensors on the sides of the highway, motion sensors, and by geo-positional and orientational tracking of each of the vehicles.

Method **700** may continue in block **706** by detecting the events, wherein the events are defined within pre-determined parameter values that are compared with the real values of activities in the real world. In yet another embodiment, detecting events further comprises classifying the events into ordinary or extraordinary events. For example, the real values may refer to the real speed of each of the cars in a highway or the average speed of all the traffic in the highway, and the predetermined standard value ranges may refer to the expected speed range of each vehicle within the highway or the expected average speed range of the traffic. If the compared real values fall within the predetermined standard value ranges, then the events may be classified as ordinary events. On the other hand, if the compared real values fall outside of the predetermined standard value ranges, the events may be classified as extraordinary events, such as when a vehicle is going at an extremely high speed, or when there has been a car accident.

Method **700** continues in step **708** by checking whether events fall within one or more predetermined analysis requirement parameters. Checking whether events fall within one or more predetermined analysis requirement parameters refers to comparing the detected event's real values with a range of predetermined analysis requirement parameter values defined to trigger analysis of the events. Determining that an event is worthwhile analyzing depends, in some embodiments, on risk factors that may be linked to the event, such as risk to safety or integrity of others, risk of contamination, risk of material damage risk, etc. Thus, events that are worthwhile analyzing may be linked to critical control points related to the one or more activities that are monitored. Examples of events that may be worthwhile analyzing may, for example, a financial card payment, a machine operation for a critical process, or behavior of one or more vehicles in a congested highway; behaviors of air, water or land vehicles; factory operations; and entertainment activities, such as video games, film-making, sports activities, TV, theater or musical performances, etc.

If the method **700** determines that the event is not worthwhile analyzing, the method **700** may loop back to step **704** by continuing to monitor the real world. If the method **700** determines that the event is worthwhile analyzing, the method **700** continues in step **710** by defining the timeframe of the events, so that the initial and ending time of the event are identified, for further storage of the event in the memory of the at least one server, as viewed in step **712**.

In step **714** the method **700** continues by recreating the events. Recreating the events may be performed by generating event data points comprising data gathered within the duration of analysis-worthwhile events. In some embodiments, recreating the events further comprises generating simulation data corresponding to duration of the events. In some embodiments, recreating of events further comprises replaying events and experiences related to the events in digital realities (e.g., augmented reality, or virtual reality, or combinations thereof).

In step **716**, the method may continue by analyzing the events, which may be performed by applying statistical and/or logical algorithms to describe, condense and evaluate the events. Analysis of events may also be performed automatically by artificial intelligence algorithms or may involve human interaction. The method **700** may end in step **718**.

According to an embodiment, recreating events in digital realities may provide event analyzers with context-rich 3D images and experiences of the events, which may be helpful during event analysis. In some embodiments, the events may be reviewed and analyzed from different perspectives. For example, a car accident event may be reviewed and analyzed in virtual reality from the perspective of any of the two or more involved vehicles for a judicial investigation in order to determine the responsibility level of each involved party. In other embodiments, recreating events may also provide other types of experiences created during generation of event data points, including simulations with audio data, haptic data, motion data, connected element or system data (like vehicular telemetry, drone telemetry) textual data (e.g., subtitles, comments, annotations, etc.), etc.

According to an embodiment, management of events further comprises operation of the events through artificial intelligence algorithms or user input. Operation of events may be performed as a result of the analysis of the events. Operation of events may trigger one or more actions on one or more real-world elements through their respective virtual replicas in the persistent virtual world system. In some embodiments, operations of events may be influenced by whether the events are ordinary or extraordinary events. Preferably, for high-risk events, analysis is performed automatically by artificial intelligence algorithms, which can determine at relatively high speeds the types of operations that may be required to rectify the events or lower the risks of the events. For example, in the case of a car accident, artificial intelligence algorithms may determine that all cars

in surrounding areas to the accident should slow down or come to a halt to prevent further damages.

According to an embodiment, management of events further comprises sharing the stored events with other users through one or more other servers. Sharing of events may be performed in order to perform further analysis of the events, further operations, or combinations thereof.

According to an embodiment, occurrence of events has an effect on the context around the events, triggering other events in the real world through the persistent virtual world system that comprise interactions between one or more real-world elements within the affected context. Such effects on the context of events may trigger further operations of real-world elements, which can provide further data for analysis of the events.

According to an embodiment, generating event data points within the duration of the event refers to identifying data corresponding to the occurrence. In further embodiments, the event data points further include contextual information. For example, during a car accident, the corresponding data points may refer to the actual footage that may translate into a media stream to be replayed to an occurrence analyzer for subsequent analysis. The data points may further include information about the speed at which the vehicles were traveling, the position and orientation, and route. In addition, in the current example, the contextual information that may be included in the data points may include the weather conditions at which the accident happened, the situation of traffic lights, other vehicles in the area, pedestrians or animals walking, or any other factors that may have an effect on the accident. The event data points may further include other data points that may be helpful during an event analysis, such as audio data, haptic data, motion data, textual data, etc. All of these data points may be used to provide a context-rich replay of the occurrence, which may be later analyzed by an occurrence analyzer.

In some embodiments, the event may be replayed as a digital reality experience to a user, where digital realities include one or more of augmented reality, virtual reality, mixed reality, or combinations thereof. Accordingly, an event analyzer, in order to review an event, may be able to view, via user devices, a context-rich 3D replay of the event in a digital reality, which may provide the event analyzer with further information that may help during the analysis. The event may be reviewed from different perspectives, such as the perspective of any of the two or more involved vehicles. For example, it is usually very time-consuming to investigate the cause of a car accident. Police have to analyze footage from different angles, obtain numerous testimonies from witnesses, etc. However, being able to view and experience the event in a digital reality, such as virtual reality, may help in speeding-up the efficiency of the investigation. In other embodiments, the replay of the events may also provide other types of experiences, including simulations with audio data, haptic data, motion data, textual data (e.g., subtitles, comments, annotations, etc.), etc. The further experiences may be generated during the creation of event data points.

In some embodiments, management may be implemented by layers, such as the layers **302** described with reference to FIG. **3**. For example, a human or artificial intelligence administrator at a district level may be responsible for monitoring a district, and may be in charge of analyzing events therein. In other examples, a human or artificial intelligence administrator at a city level may be responsible for monitoring a city, and may be in charge of analyzing events therein.

While certain embodiments have been described and shown in the accompanying drawings, it is to be understood that such embodiments are merely illustrative of and not restrictive, and that the invention is not limited to the specific constructions and arrangements shown and described, since various other modifications may occur to those of ordinary skill in the art. The description is thus to be regarded as illustrative instead of limiting.

The invention claimed is:

1. A system comprising:

a server system comprising one or more server computers, each server computer comprising memory and at least one processor, the server system including a database with structured data storing a persistent virtual world system comprising virtual replicas of real-world elements; and

a plurality of connected elements connected to the server via a network, each connected element comprising communication circuitry and one or more sensing mechanisms configured to capture data from one or more of the real-world elements,

wherein the server system is configured to synchronize the persistent virtual world system with the real-world elements using dynamic data captured by the connected elements and static data, and to enable live management of events in the real world through the synchronized persistent virtual world system.

2. The system of claim **1**, wherein the management of the events comprises one or more of the following:

monitoring activity in the real world through the persistent virtual world system;

detecting the events, wherein the events are defined within pre-determined parameter values that are compared with real values of activities in the real world;

checking whether the events fall within one or more predetermined analysis requirement parameters, wherein the checking step comprises, in a negative case where an event falls outside the one or more predetermined analysis requirement parameters, continuing to monitor activity in the real world, and in a positive case where the event falls within the one or more predetermined analysis requirement parameters, the process continues by:

defining a timeframe of the event;

storing the event in the memory;

recreating the event; and

analyzing the event.

3. The system of claim **2**, wherein detecting the events further comprises classifying the events into ordinary or extraordinary events.

4. The system of claim **2**, wherein recreating the event comprises generating event data points comprising data gathered within the duration of the event, or generating simulation data corresponding to duration of the event, or combinations thereof.

5. The system of claim **1**, wherein the management of the events comprises operation of the events through artificial intelligence algorithms or user input, and wherein said operation of the events triggers one or more actions on the one or more real-world elements through the respective virtual replicas in the persistent virtual world system.

6. The system of claim **1**, wherein the management of the events comprises sharing stored events with one or more users.

7. The system of claim 1, wherein the events have an effect on context around the events, triggering other events in the real world through the persistent virtual world system that comprise interactions between one or more real-world elements within the affected context.

8. The system of claim 1, wherein the events are generated by artificial intelligence algorithms, user input, or combinations thereof, and wherein the events can be further influenced by natural occurrences.

9. The system of claim 1, wherein the persistent virtual world system is structured by layers comprising outer and inner layers, wherein outer layers define broad geographical areas and inner layers define smaller geographical areas within the outer layers, and wherein the management of the events is implemented by said layers.

10. The system of claim 1, wherein the events relate to data generated during financial transactions; air, water, or land vehicles behavior; machine or factory operations; or entertainment activities; or a combination thereof.

11. A method comprising:

providing in memory of a server system a database with structured data storing a persistent virtual world system comprising virtual replicas of real-world elements;

synchronizing the virtual replicas with the respective real-world elements using dynamic data and static data from a plurality of connected elements connected to the server system via a network, the connected elements comprising sensing mechanisms configured to capture the dynamic data from the real-world elements; and

managing events in the real world through the synchronized persistent virtual world system.

12. The method of claim 11, wherein managing the events in the real world comprises one or more of the following:

monitoring activity in the real world through the persistent virtual world system;

detecting the events, wherein the events are defined within pre-determined parameter values that are compared with the real values of activities in the real world;

checking whether the events fall within one or more predetermined analysis requirement parameters, wherein the checking step comprises, in a negative case where an event falls outside the one or more predetermined analysis requirement parameters, continuing to monitor activity in the real world, and in a positive case where the event falls within the one or more predetermined analysis requirement parameters, the process continues by:

defining a timeframe of the event;

storing the event in the memory;

recreating the event; and

analyzing the event.

13. The method of claim 12, wherein detecting the events further comprises classifying the events into ordinary or extraordinary events.

14. The method of claim 12, wherein recreating the event comprises generating event data points comprising data gathered within the duration of the event, or generating simulation data corresponding to duration of the event, or combinations thereof.

15. The method of claim 11, wherein the management of the events comprises operation of the events through artificial intelligence algorithms or user input, and wherein said operation of the events trigger one or more actions on the one or more real-world elements through the respective virtual replicas in the persistent virtual world system.

16. The method of claim 11, wherein the management of the events comprises sharing stored events with one or more users.

17. The method of claim 11, wherein the events have an effect on context around the events, triggering other events in the real world through the persistent virtual world system that comprise interactions between one or more real-world elements within the affected context.

18. The method of claim 11, wherein the events are generated by artificial intelligence algorithms, user-input, or combinations thereof, and wherein the events can be further affected by natural occurrences.

19. The method of claim 11, wherein the persistent virtual world system is structured by layers comprising outer and inner layers, wherein outer layers define broad geographical areas and inner layers define smaller geographical areas within the outer layers, and wherein the management of the events is implemented by the layers.

20. A non-transitory computer readable medium storing a program configured to cause one or more processors to perform steps comprising:

providing a database with structured data storing a persistent virtual world system comprising virtual replicas of real-world elements;

synchronizing the virtual replicas with the respective real-world elements using dynamic and static data obtained from a plurality of connected elements connected to a server via a network, the connected elements comprising sensing mechanisms configured to capture the dynamic data from the real-world elements; and

managing events in the real world through the synchronized persistent virtual world system.

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